are finely regulated to enable the processes of living organisms to happen in the right place and at the right time.

How is genetic engineering done?

Because living organisms have natural barriers to protect themselves against the introduction of DNA from a different species, genetic engineers have to find ways to force the DNA from one organism into another. These methods include:

- Using viruses or bacteria to "infect" animal or plant cells with the new DNA.
- Using electric shocks to create holes in the membrane covering sperm, and then forcing the new DNA into the sperm through these holes.
- Injecting the new DNA into fertilized eggs with a very fine needle.
- Coating DNA onto tiny metal pellets, and firing it with a special

Is genetic engineering precise?

The technology of genetic engineering is currently very crude. It is not possible to insert a new gene with any accuracy, and the transfer of new genes can disrupt the finely controlled network of DNA in an organism.

Current understanding of the way in which DNA works is extremely limited, and any change to the DNA of an organism at any point can have side effects that are impossible to predict or control. The new gene could, for example, alter chemical reactions within the cell or disturb cell functions. This could lead to instability, the creation of new toxins or allergens, and changes in nutritional value.

For example, when genetically engineered salmon were compared to normal salmon, it was found that the genetic engineering unexpectedly increased the amount of a protein identified as a major food allergen.[3] In another case, Australian researchers reported in November 2005 that after 10 years spent developing a genetically engineered pea they had to abandon project after they found out that the altered peas caused lung inflammation and other adverse effects in mice.[4] "The reaction of the mice...might reflect something that would happen to humans," said deputy chief of CSIRO plant industry T. J. Higgins.[5]

Why do genetically engineered foods have antibiotic resistant genes in them?

The techniques used to transfer genes have a very low success rate, so the genetic engineers attach "marker genes" that are resistant to antibiotics to help them to find out which cells have taken up the new DNA. These marker genes are resistant to antibiotics that are commonly used in human and veterinary medicine. Some scientists believe that eating GE food containing these marker genes could encourage gut bacteria to develop antibiotic resistance.

"We have such a miserably poor understanding of how an organism develops from its DNA that I would be surprised if we don't get one rude shock after another."
— Richard Lewontin, Professor of Genetics at Harvard University[2]

1. Statistics on field tests for genetically engineered crops available on the website of "Information Systems for Biotechnology" established as part of the National Biological